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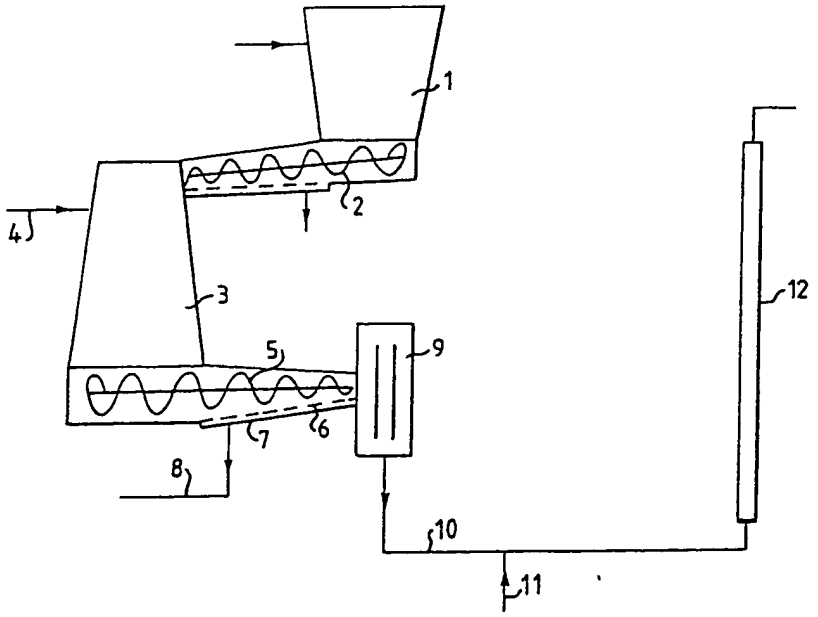
(54) Title: DEFIBERING OF FIBRE MATERIAL



(57) Abstract

A method for the defibration of lignocellulose-containing fibre material; such as wood chips, bagasse or the like, comprising preheating the fibre material with steam under pressure at a temperature of 140-190 °C in a preheater (3) and subsequent defibration under pressure in a defibrator (9). The fibre material is transferred from the preheater (3) to the defibrator (9) and simultaneously compressed and dewatered in a compressing worm (5) with a compression ratio of 1.5-3, preferably 2-3, for lowering the moisture ratio of the fibre material.

Defibering of fibre material

This invention relates to the defibration of lignocellulose-containing fibre material, such as wood chips, bagasse or the like, which is intended to be formed to fibreboard by forming and pressing.

At the manufacture of fibreboard according to the dry method, fibre material is fed to an infeed bin, in which a certain preheating with steam of atmospheric pressure takes place. The fibre material can be moist chips, which normally have been washed in a chip washer. A feeding screw, which brings about an air-tight plug, then feeds the chips to a pressurized preheater where the chips are heated with steam of a predetermined pressure for a certain period of time, whereafter the chips are fed further via some type of worm conveyor to a refiner where defibration is carried out between two refiner discs. The defibered fibre material normally is mixed with resin during its transport in a blow line and blown by steam to a fibre drier where the fibres are dried to a moisture ratio of ca. 0.1, then are transported to a fibre bin and thereafter formed to a fibre mat, which is pressed in a hot press to a complete board.

The fibres, alternatively, can be mixed with resin in a mixer after the drying. The drying can be carried out in a fibre drier of one- or two-step type. The complete boards can be manufactured as boards of one or several layers. The latter type requires several production lines according to above arranged in parallel.

The preheated material normally is transferred from the preheater to the defibrator by a straight worm conveyor, which advances the material without compressing it. Modern defibrators are fed laterally, i.e they comprise a worm feeder, which compresses the material slightly and feeds it to a worm belt, which in its turn feeds the chips into the beating zone between the refiner discs.

A slight compression was chosen, because the steam, which is produced at the refining and flows rearward against the chips via a by-pass pipe connected to the preheater top, is desired to be returned to the preheater for being used in the preheating.
At a method of re-using the produced steam under pressure, as disclosed in the patent SE-8200943-2, a compressing worm feeder of straight-feed design is used.
Further examples of compressing worm feeders of straight--feed design are shown in the patents SE-7603464-4 and 8302014-9.
These patents refer to applications at the manufacture of papermaking pulp, where the pressure in the preheater is kept lower than in the refiner housing in order to achieve a pulp of highest ISO-brightness. At the manufacture of papermaking pulp, defibration and treatment take place in the refiner. This requires high energy input and at the same time produces much steam. As mentioned above, the worm feeder there is intended to prevent the steam from flowing rearward. The compressing worm feeder in these cases, thus, has the object to adjust the pressure difference between preheater and refiner housing. The degree of compression is low. The prerequisite conditions of interest at these applications, therefore, have been different from those at the defibering of fibre material for the manufacture of fibreboard according to the dry method.

At the manufacture of fibreboard according to the dry method, the moist fibres shall be dried to the moisture ratio mentioned above. The moisture ratio of ingoing chips can vary considerably, from 0.2 to 2.0 when no chip washer is used, but after chip washing normally is about 1.3. During the heating of the chips in the feeder bin and preheater, additional moisture is supplied via the steam. Part of this moisture is pressed out in the worm feeder to the preheater, and an additional amount is

allowed to evaporate during the energy-intensive refining, whereafter moisture is added with the size introduced in the blow line. Remaining moisture minus the residue moisture 0.1, however, must be evaporated in the drier. The drier used at the manufacture of fibreboard is of tubular type, where ingoing air temperature is about 160°C and outgoing air temperature is about 60°C, and where the efficiency degree is correspondingly low. The drying, therefore, requires a relatively high energy input per ton of evaporated moisture.

According to the invention, the energy consumption is reduced due to the fact, that the fibre material at the transfer from the preheater to the defibration is compressed at a compression rate of 1.5-3, preferably 2-3, and dewatered so that the material after defibration has a moisture ratio as low as possible. The energy demand at the subsequent drying can hereby be reduced substantially. The invention implies, that the total energy consumption at fibreboard manufacture can be reduced. The characterizing features of the invention are apparent from the attached claims.

The invention is described in greater detail in the following, with reference to the accompanying Figure, which schematically shows an embodiment of a plant for the manufacture of defibered fibre material according to the invention.

Chips are fed from an infeed bin 1 by a worm feeder 2, which produces an air-tight plug, into a preheater 3, where the chips are heated by steam via a conduit 4 to 140°C - 190°C, preferably 160°C - 180°C. In the worm 2 a certain dewatering takes place. After the preheater 3 a compressing worm 5 is located, which has a compression ratio of 1.5-3, preferably 2-3, i.e. the ratio between the free area of the worm at the inlet and the corresponding area at the outlet. The casing 6 of the worm is provided with a great number of apertures or slits, so that

an effective dewatering can be achieved. The water pressed out is collected in an air-tight casing 7 and discharged through a conduit 8 to a cleaning plant or returned to the infeed bin 1 for heating the chips. The chips then can be fed from the worm 5 directly to the defibrator 9 or to the refining zone of the defibrator via an angled worm belt, which breaks up the chip plug and ensures uniform infeed to the refining zone of the defibrator. The defibered material is transported in a blow line 10, into which resin is introduced through a conduit 10. Thereafter drying takes place in a tubular drier 12, whereafter the fibres are transferred to a forming station where fibreboard is formed in a manner known per se.

Due to the compression and dewatering of the fibre material in the worm 5, the moisture ratio of the material fed into the defibrator 9 is lowered to 0.7-1.1, suitably 0.7-0.9, preferably about 0.8, and of fibre admixed with resin after the blow line to 0.4-0.5. The heat demand in the drier can hereby be almost halved. For a new plant, therefore, only slightly more than half the drier size is required. This implies for a plant producing 50 000 tons of board per annum a reduction in drying energy at certain prerequisite conditions counted in oil equivalents about 2150 m^3 oil/year, in addition to the lower investment costs for the drier.

To this are further to be added reduced costs for almost halved fan energy for the drier as well as almost halved emissions of impurities in the drier exhaust gases, alternatively reduced size of required cleaning equipment. In certain cases the installation of any cleaning equipment can be abandoned.

For an existing plant, the invention implies that the inlet temperature in the drier can be lowered substantially, which results in lower drying costs. Besides, in cases when the drier was limiting the production, the production can be increased. An additional saving probably can

be made in the amount of resin, because the resin consumption can be expected to decrease due to the lower drying temperature. All together, even in this case the saving will be substantial.

By increasing the compression ratio and dewatering in the infeed worm 2, the moisture content of the chips fed into the defibrator 9 and drier 12 can be lowered further. An increase in the compression ratio from 1.8 to 2.8 yields a decrease in drying energy by about 10%.

A drier fibre material also has a lower weight and is thereby easier to transport in the blow line, thereby reducing the demand for additional steam required for the transport.

As mentioned above, the hot water collected from the compressing worm 5 is recovered and returned through the conduit 8 to the infeed bin 1 for heating ingoing cold chips. A considerable saving in steam to the preheater 3 is hereby obtained. Several different designs can be imagined in this respect, depending on whether or not the plant has a chip washer, and whether the chips are pre--steamed in the infeed bin 1. When the plant comprises chip washing, the hot water preferably can be returned via the conduit 8 for use in the chip washer.

At a simple application, the hot water returned through the conduit 8 is mixed with the cold chips in the infeed bin 1, so that temperature equilibrium is obtained. Tests have shown, that such a state can be achieved within a few minutes. By this heating, at certain prerequisite conditions, a saving of 30-35% in the steam demand for the preheater 3 can be made.

Still more energy can be saved when the water pressed out from the worm 2 before the preheater 3 is passed to a chip washer. At an annual production of 50 000 tons of board, about 800 m^3 oil, counted in oil equivalents, can be saved. In a new plant, besides, the size of the steam

boiler system can be reduced, thereby lowering the investment costs and very probably well compensating for the excess cost of the compressing worm 5 after the preheater 3.

Compared with conventional defibering, at given prerequisite conditions, the waste flow from the worm 2 before the preheater 3 increases from 0.2 to 0.55 m^3/ton dry substance, which is an amount capable to be handled even when for environmental reasons water purification would be required. It is to be observed that the amount of water-soluble substance in this flow is smaller than that in the hot water from the compressing worm 5 after the preheater 3, because part of the hot water is re-circulated.

Another alternative is to flash off by pressure drop the hot water pressed out and to utilize the steam for pre-steaming the chips in the infeed bin 1 at the same time as the hot water is returned to the chip washer.

The invention is not restricted to the embodiments described, but can be varied within the scope of the invention idea.

Claims

1. A method for manufacturing fibreboard according to the dry method by defibration of lignocellulose-containing fibre material, comprising preheating of the fibre material with steam under pressure at a temperature of 140-190°C in a preheater (3) and subsequent defibering under pressure in a defibrator (9), admixing resin in the fibre material in a blow line after defibration, drying the fibre material to a moisture ratio of about 0.1 and forming the fibre material to fibreboard, c h a r a c t e r i z e d i n that the fibre material is fed by a worm feeder (2) air-tight from an infeed bin (1) to the preheater (3) and simultaneously dewatered with a compression ratio of 2-3, that the transfer of the fibre material from the preheating to the defibration takes place while the material simultaneously is compressed and dewatered in a compression worm (5) with a compression ratio of 1.5-3, preferably 2-3, for lowering the moisture ratio of the fibre material to 0.7-1.1, preferably to 0.7-0.9, and further lowering the moisture ratio of the fibre material by defibration so that the moisture ratio after defibration and admixing of resin is 0.4-0.5.

2. A method as defined in claim 1, c h a r a c t - e r i z e d i n that the water separated from the compressing worm (5) is re-circulated for heating the fibre material before the preheater (3).

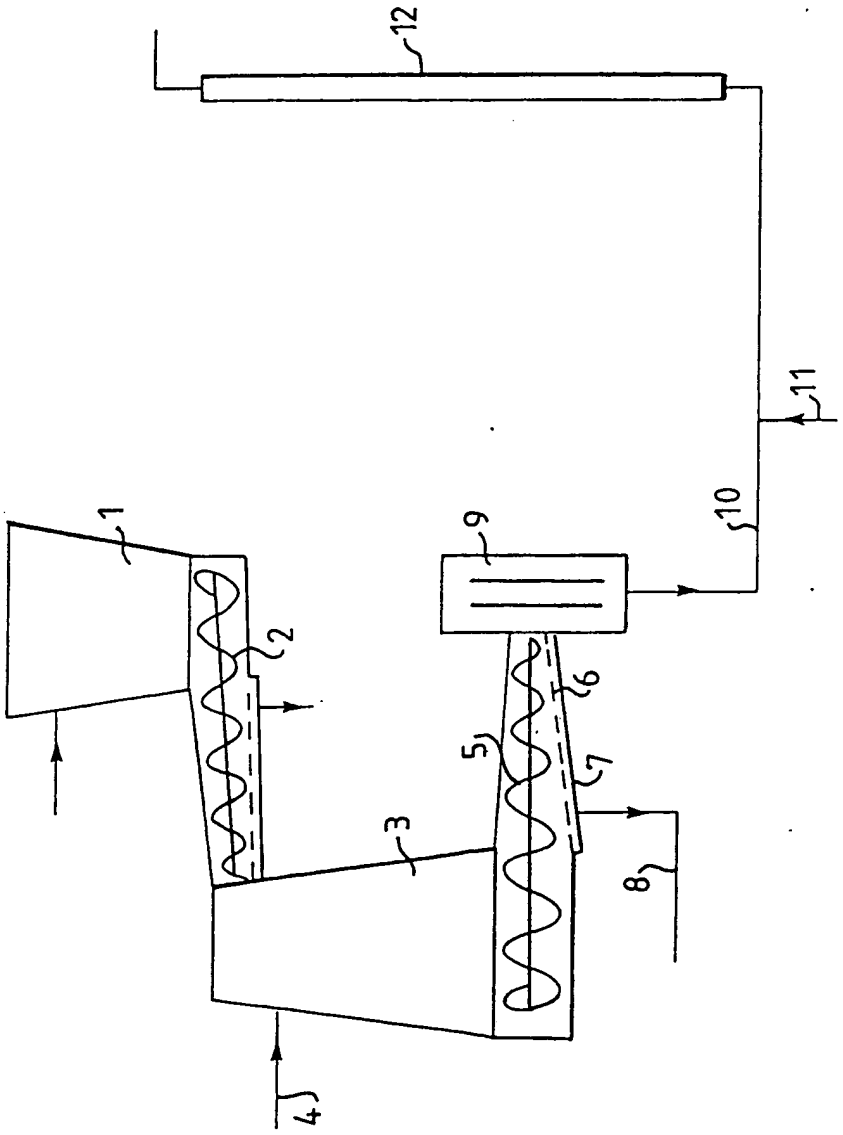
3. A method as defined in claim 2, c h a r a c t - e r i z e d i n that the water is re-circulated to the infeed bin (1) before the preheater (3).

4. A method as defined in claim 2, c h a r a c t - e r i z e d i n that the water is re-circulated to a washer, from which the fibre material via the infeed bin (1) is fed into the preheater (3).

5. A method as defined in claim 1, c h a r a c t - e r i z e d i n that the water separated from the compressing worm (5) is allowed to expand, that the steam going off is

utilized for pre-steaming the fibre material in the infeed bin (1) before the preheater (3), and that the water is used at the washing of the fibre material in a washer before the infeed bin (1).

6. A method as defined in claim 1, c h a r a c t - erized i n that the water separated from the worm feeder (2) is re-circulated to be used at the washing of the fibre material before the infeed bin (1).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INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00320

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: D 21 B 1/12

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	D 21 B; D 21 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	SE, B, 376267 (S.D. SELANDER) 12 May 1975, see page 7, line 3 - line 10; the figure --	1-6
Y	SE, B, 413784 (ISEL SA) 23 June 1980, see page 3, line 12 - line 25; the figure --	1-6

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* Special categories of cited documents:[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
4th September 1991	1991 -09- 12
International Searching Authority: SWEDISH PATENT OFFICE	Signature of Authorized Officer: Wiva Asplund

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 91/00320

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-07-31
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		AU-D-	7645574	76-06-17
		BE-A-	823905	75-06-27
		CA-A-	1027404	78-03-07
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